Chapter 15
Sleep Disorders

Abstract Sleep is a natural, repetitive function of the brain that restores energy and partially maintains mental and physical health. Disruptions in sleep, particularly slow-wave sleep, are associated with mood disturbance, decreased function, and physical illness. The Pathways Model is useful in understanding sleep disorders, whether they be primary or secondary to depression or anxiety. Two examples are presented in this chapter to elucidate the three levels of interventions as applied to one case of primary and one case of secondary sleep disorder.

Keywords Sleep/wake cycle • Sleep disorders • Interventions • Sleep hygiene

Introduction: Normal Sleep

Humans sleep to conserve energy, to control body temperature, and to maintain physical and emotional health. The necessary length of a person's sleep is determined by their ability to function during the day without feeling drowsy. Alert people will not become sleepy because they are sitting still or bored. Some adults need up to 8–9 h of sleep in a 24-h period; others can function quite well on 5–6 h of sleep. Variation also exists in the timing of optimal functioning, whether early morning or evening (Aeschbach et al., 2003).

All mammals that have been studied demonstrate regular sleep patterns and suffer consequences of sleep deprivation. In humans, the sleep rhythm develops during the first 2 years of life and follows a 24-h cycle. During a normal night, about 75% of the time consists of slow-wave, restorative sleep, characterized by high-amplitude, low-frequency brain waves, and 25% is rapid eye movement (REM) or dream sleep (Sadock & Sadock, 2008).

Sleep length is influenced by many factors, including heredity, age, need for vigilance, number of hours of awake time, stimulation, social learning, conditioning, and daily routine. If the person needs to be vigilant or there is too much noise or light, falling asleep will be more difficult, whereas long hours of wakefulness

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speed sleep onset. The sleep–wake cycle is primarily controlled by the circadian clock, which is influenced by a complicated network of molecular clocks in the brain and regulatory genes, which in turn control oscillations of neurons and other peripheral clocks in the body (Hamet & Tremblay, 2006).

In order to effectively assist patients with sleep disorders, it is important to understand the interrelationships among the sleep–wake cycle and other biological rhythms. These include body temperature, appetite, and hormone levels, particularly of cortisol, epinephrine, and growth hormone. The lowest body temperature usually occurs in the early morning hours, and the highest occurs during early evening. Appetite and satiety are controlled by neuronal centers in the hypothalamus, which are linked to the internal time-keeping clocks (Froy, 2010). Leptin, a neurochemical that decreases appetite, is suppressed during short sleep and other hormones that stimulate the desire to eat are increased. Finally, the hypothalamic–pituitary–adrenal (HPA) axis is involved in both the stress response and the sleep–wake cycle, and thus, these two physiological cycles interact within a multidimensional framework (Buckley & Schatzberg, 2005).

Sleep Deprivation and Its Effects

Sleep deprivation can be classified in two ways: the number of hours of missed sleep or the duration of deprivation, i.e., the number of days. Total sleep deprivation, a rare phenomenon, is defined as complete lack of sleep; partial deprivation refers to less sleep than usual. A few days of partial or total sleep deprivation is labeled as acute, whereas chronic deprivation refers to partial deprivation for years. After prolonged wakefulness, the drive to sleep is so strong that sometimes despite the person's best efforts to stay awake, a microsleep (20- to 30-s doze) occurs. Microsleeps can have severe consequences if they happen during potentially dangerous activities, such as driving or using machinery (Woodward, 2003).

Insufficient sleep or multiple awakenings during the night are associated with mood disruption, particularly irritability, anxiety, and depression (Hamilton, Catley, & Karlson, 2007; Zohar, Tzischinsky, Epstein, & Lavie, 2005). Evidence is building that misalignment between the sleep–wake cycle and the circadian rhythm oscillators in the brain contributes to clinical-level psychopathology (Kripke, Nievergelt, Joo, Shekhtman, & Kelsoe, 2009). For example, patients with depression complain of early morning awakenings (terminal insomnia) while anxious patients often have difficulties with first sleep onset (onset insomnia). Although specific evidence that supports clock genes' role in anxiety and depression is lacking, a stronger case can be made for mistiming of the brain clocks in bipolar disorder and dementia (Hamet & Tremblay, 2006; Lamont, Legault-Coutu, Cermakian, & Boivin, 2007).

The relationship among poor sleep quality, fewer hours of sleep, and worsening pain is well established (Hamilton et al., 2007). In healthy normal sleepers, as little as 4 h of sleep deficit produced hyperalgesia the following day (Roehrs, Hyde, Blaisdell, Greenwald, & Roth, 2006). Another example of the importance of restor-

ative sleep is in fibromyalgia, a pain condition discussed in detail in an earlier chapter. Patients reporting continuous, high-quality sleep suffer less intense pain and are also able to cope more effectively with negative life events (Hamilton et al., 2008).

The HPA axis has multiple effects on sleep quality and quantity (Buckley & Schatzberg, 2005). A rise in cortisol must occur to prepare the person for morning wakefulness, stimulate the appetite, and increase blood pressure and heart rate in anticipation of physical activity. In contrast, hyperactivity in HPA activity has multiple negative effects. Slow-wave sleep decreases, cortisol levels increase at inappropriate times, and sleep is disrupted. The vicious cycle of broken sleep, increased arousal, and insomnia continues, since sleep deprivation is associated with further activation of the hypothalamic–pituitary axis.

The internal body clock is located in the part of the brain called the suprachiasmatic nucleus (SCN). Although light sets the main clock in the SCN, there are also oscillators—peripheral clocks in other cells and tissues in the body. In addition to light, shift work, lack of sleep, and anxiety affect the internal clocks. Disruption in sleep can block the body's normal circadian rhythm, alter insulin production, and change the levels of other hormones that are important to weight control. Sleep-deprived people produce more of the hormone that promotes hunger (ghrelin) and less of the hormone that suppresses appetite (leptin). To emphasize this point, medically healthy individuals who had their sleep disrupted for several consecutive nights had elevated blood glucose and elevated insulin after the sixth consecutive night of disruption. After a big meal, the increase in glucose levels in the blood turns off the neurons that produce orexin, making people feel sleepy. Daytime fatigue is partially explained by the change in the normal rhythm of fatigue-producing cytokines, such as IL-6. These substances can be conceptualized as primordial signals to the human brain to conserve energy after eating (Froy, 2010).

The Case of Brandon

Brandon was a 23-year-old in his second year of law school who presented with complaints of onset insomnia and terminal insomnia for the past month. It was taking him more than an hour to fall asleep several times a week. His daytime fatigue was described as "exhaustion." Brandon was worried about completing his class requirements and thought that maybe he had chosen the wrong profession. He was attending class every day, but it was a struggle to stay awake. His daily consumption of caffeine was 4–6 cups of coffee per day, a pattern that began when he started school 8 months ago. Brandon had no time for exercise, nor was he eating a balanced diet. He was on no medication and had no medical diagnoses. Alcohol consumption, mainly on the weekends, was described as 3 or 4 beers with law school friends.

The assessment process began with Brandon keeping a 2-weeks sleep and activity log prior to his first appointment. A careful history revealed that as a child, Brandon had sleep problems; he was a hard child to get to sleep and then he woke up once or

twice a night until he was almost 3. During his teenage years, Brandon stayed up until midnight on school nights and had great difficulty getting up in the morning.

The most likely diagnosis for Brandon was primary insomnia. Although he was anxious and worried, he did not meet the criteria for generalized anxiety disorder. At times, he experienced sadness and became hopeless about his progress in law school, but he did not fulfill diagnostic criteria for any mood disorder.

Insomnia is one of the dyssomnias and is the most common sleep disruption among adults. Patients commonly complain about problems initiating and maintaining sleep or feeling fatigued during the day. Primary insomnia occurs without medical or psychiatric cause and cannot be due to substance use or medication (Morin et al., 2006).

Management of insomnia relies on multiple options, which include the benzodiazepines or the non-benzodiazepine classes of medicine, melatonin, light therapy, or one of several behavioral interventions (Buscemi et al., 2004; Morgenthaler et al., 2006).

According to the Pathways Model, Brandon's sleep problems were partially genetic in origin, later influenced by social learning and modified by current stressors. Intervention for Brandon began with education about the natural need for sleep and the relationship among disrupted sleep patterns and other circadian rhythms, such as appetite/satiety, temperature regulation, and mood. Brandon's onset insomnia and early awakenings short-circuited his restorative, slow-wave sleep and led to fatigue during the day. This information helped Brandon to understand why he was sleepy when he should be alert and sometimes very hungry at 2 am.

Level One interventions. The Level One interventions of self-soothing and mindful breathing were recommended for Brandon. He was taught mindful breathing and encouraged to use this technique every day and at bedtime. The recommended soothing technique was listening to repetitive sounds, such as music with a repeating pattern or ocean waves. We also recommended some of the sleep hygiene recommendations for Brandon (see the Box 15.1 for typical sleep hygiene recommendations) (CCI, 2013; Sadock & Sadock, 2008). These included discontinuing stimulants after 6 pm and regulating food intake so that the largest meal was not within 2 h of bedtime. Abstinence from alcohol was important; alcohol does put people to sleep, but the sleep is disrupted and fragmented, containing fewer minutes of slow-wave sleep (Morin et al., 2006). Brandon was advised to take a hot bath or shower near bedtime. When the brain cools after the bath, it will facilitate sleep, since there is a natural tendency to fall asleep when the brain is losing heat.

In summary, Brandon's habits of drinking a cup of coffee in the evening, eating his biggest meal around 7–8 pm, and studying in bed were discontinued. He could take a nap during the day if he felt sleepy but not for longer than 45 min and not within 4 h of planned bedtime. Brandon was willing to make these adjustments in his schedule. He changed his larger meal to noon and ate two smaller meals, one at 6 pm and one at 10 pm, the latter a complex carbohydrate meal. The typical sleep hygiene recommendation of going to bed and waking up at the same time every day was not realistic for Brandon. His classes were at different times from Monday to Friday and his part-time job required him to work weekends from 3 to 11 pm.

Box 15.1 Sleep Hygiene: Good Habits for Better Sleep

1. Have a routine. Go to bed and wake up at about the same times, even on weekends.
2. Keep room temperature comfortable; limit light and noise.
3. Avoid heavy exercise within 3 h of bedtime.
4. Avoid large meals within 3 h of bedtime. A light snack containing carbohydrate before going to bed is appropriate.
5. Limit caffeine consumption to the morning hours.
6. Do not watch TV, read stimulating books, or listen to loud music at bedtime.
7. If you do not fall asleep within 30 min, get up and do something until you feel sleepy. Do not linger in bed awake during the night or in the morning.

Adapted from http://www.cci.health.wa.gov.au

Level Two interventions. Brandon began the breathing and soothing exercises and returned in 2 weeks. He reported some improvement in feelings of anxiety during the day, but sleep was still compromised. The Level Two intervention was progressive relaxation, based on the premise that Brandon's difficulties in going to sleep and maintaining sleep were due to excessive muscle tension. This made intellectual sense to Brandon, because he described tense muscles in his neck and shoulders, particularly after long hours at the computer. He was also instructed to clear the bedroom of study materials in order to recondition the bed and bedroom with the onset of sleep, instead of with stimulating activities (this strategy is called sleep control therapy) (Giardino, McGrady, & Andrasik, 2007). In addition, he was encouraged to limit activities in the bedroom to sleep and sex, in keeping with the guidelines of sleep hygiene. Watching television, engaging in conversation (or worse, arguing), and extensive reading can all elicit arousal rather than physiological relaxation (Stepanski & Wyatt, 2003).

The decision to proceed through Level One and Two platforms before beginning his Level Three intervention of cognitive behavioral therapy (CBT) was carefully considered and negotiated with Brandon. Although his self-doubts about becoming a lawyer were major issues, insomnia and anxiety were what brought Brandon to therapy. So the presenting problems had to be addressed first. CBT (Jacobs, Pace-Schott, Stickgold, & Otto, 2004; Jansson & Linton, 2005) targeted the negative thoughts that Brandon held about his inability to fall asleep as well as deeper issues about his choice of profession. Dysfunctional cognitions and distress about sleep needed to be identified, countered, and finally replaced with more positive thoughts about the ability to get to sleep. Brandon's statement: "when I sleep badly, I cannot do any studying" was challenged by the therapist. This cognitive strategy, called "hypothesis testing," was successful since on that particular day, Brandon had already completed one class assignment. He felt sleepy during the day, but he could accomplish *some* studying (Edinger et al., 2001).

After 6 weeks, Brandon reported a significant improvement in sleep. Because he was less fatigued, his studies did not seem as overwhelming and he became less anxious. He no longer noticed any microsleeps. Now, CBT was applied to his concerns about his law career. When Brandon was in his first year of law school, he was fascinated by the courses on Criminal Justice. In his second year, the professor teaching Commercial Paper was not engaging and the subject matter was of less interest. The volume of required reading on this topic and the competition with other students increased his self-doubts and worry. Brandon began to wonder if he had made a mistake in choosing law as a profession. Negative thoughts became more frequent and soon he questioned his ability to successfully complete the courses. Brandon's older brother had begun law school and flunked out, to the great disappointment of their parents. Throughout therapy, he worked to counter the negative, catastrophic thoughts of flunking out "just like big brother" and labeling a wrong career choice as a "failure" with more reality-based thinking patterns.

Case Summary

Although Brandon briefly considered dropping out of school, he realized that extreme fatigue and anxiety had negatively colored his views of law, law school, and his own performance. At the completion of therapy, Brandon was close to completing law school and had decided to specialize in criminal trial work. He continued to use the relaxation techniques and the rational thinking that he learned in CBT. He monitored his sleep quantity and quality. During stressful periods of examinations, when his hours of sleep shortened, he utilized the self-soothing and healthy sleeping techniques again with good results.

The Case of Cerise

Cerise was a 40-year-old divorced mother of a 10-year-old girl who presented with almost identical symptoms to those of Brandon. Cerise had trouble falling asleep for more than 1 month and awakened between 4:00 and 5:00 AM no matter how tired she was at bedtime. Cerise had been divorced for 2 years and had joint custody of her daughter with her ex-husband. Their daughter, Rachel, spent alternate weeks with Cerise and her father. He had already remarried and was seemingly very happy in his new relationship with his wife and his wife's two daughters by her first marriage. During the weeks that Rachel was with her father, Cerise felt sad and lonely. But when mother and daughter were together, Rachel frequently complained that the house was too quiet and that there was not enough going on. Rachel said that at her dad's house there was always something happening and her stepsiblings were fun.

When discussing her work situation, Cerise became very tearful and had difficulty describing what had happened during the past months. There was downsizing at her insurance company. Cerise retained her job for which she was very grateful, but the

workload increased. Her two close friends were let go, leaving her as the only worker in a three-person office, surrounded by empty desks and idle computers. She questioned her ability to maintain productivity, but the major problem was her sense of isolation and the lack of communication with other workers.

Close examination of the contents of the interview and description of mood during the past 2 months indicated a major depressive disorder (MDD). The sleep disruption in this case was not a primary sleep disorder, like Brandon's, but a component of MDD, which is covered in detail in another chapter. Individuals with psychiatric disorders commonly have sleep disruptions of characteristic types. The person with MDD has terminal insomnia, waking up too early in the morning and not being able to get back to sleep, reduced slow-wave restorative sleep, and increased length of the dream phases of sleep (Hamilton et al., 2008). Cerise began treatment for MDD, but her insomnia also required intervention.

Cerise's pathway to illness resided in a family history of depression, a difficult break up of her marriage, and an inflexible coping style. When confronted with stressful situations, Cerise became quiet and tended to withdraw. She lacked assertiveness and clear communication skills. She became more and more isolated in all aspects of her life: home, social, and job life. Her two friends who were downsized were so angry with the company that they were not comfortable in social situations with Cerise. In addition, Cerise was prohibited to discuss the business of the office with her two friends and admittedly became tired of listening to them complain about how they were treated.

According to Hawkley, Preacher, and Cacioppo (2010), loneliness impairs daytime functioning no matter how many hours a person actually sleeps. Social isolation leads to poor sleep quality whereas social engagement during the day facilitates better slow-wave, deep sleep (Cacioppo et al., 2002). It has been suggested that loneliness and isolation bring on feelings of threat, making it difficult to go to sleep and increasing nighttime awakenings. In contrast, sleeping in a safe environment promotes restorative sleep (Cacioppo & Hawkley, 2009). In the study by Hawkley et al. (2010), persons who scored higher on a paper and pencil test of loneliness reacted to negative social words and evidenced more interference in a cognitive task than did those persons who are well integrated socially. Further, loneliness and negative attitudes and feelings impair the ability to maintain attention and concentration needed at the workplace. This research fits Cerise very closely. Since the company downsized and she was left in an office for three by herself, she had become sad and tearful and had problems concentrating, resulting in lowered motivation for her job.

Level One interventions. The Level One interventions for Cerise were communication and movement. It was recommended that Cerise step out of her office and engage in conversation with other people at her workplace. Once she did this, she realized that there were other individuals who felt as isolated as she did because of the downsizing. Cerise was also advised that during the weeks that Rachel was with her, she should find at least one activity that she and her daughter could share. The second Level One recommendation—*move*—was a prelude to recommending an exercise regimen. Since exercise can improve cognitive functions, such as memory and concentration, moving was the first step towards a regular exercise program (Ferris, Williams, & Shen, 2007; Ruscheweyh et al., 2009). Cerise and Rachel began to walk to the park that was a half mile from home where Rachel met another girl from her school.

Moving began to mobilize energy in Cerise's body and slightly improved mood. A more formal exercise program was begun later, with physician approval.

Level Two interventions. The Level Two recommendations for Cerise were progressive relaxation and exercise. This type of relaxation was chosen because it is active relaxation and serves to direct attention to the experiences of tension and relaxation (McGuigan & Lehrer, 2007). Cerise was advised to practice relaxation every day for 15 min with the CD that was provided. Within 2 weeks, Cerise noticed some improvement in sleep quality, but the early morning awakenings continued and her mood remained depressed.

Cerise told Rachel that every Wednesday that they were together, they would go to the local YMCA, where Rachel could take swimming lessons, while Cerise swam laps. Initially, low motivation made it very difficult to follow through with this part of the plan and some evenings Cerise had to "drag" herself out of the house. However, within 5 weeks of swimming 3–4 times per week, a striking and unexpected improvement in work performance, particularly in those tasks required focus and attention, was noticed during the days after swimming. Cerise reported this observation and the few pounds of exercise-associated weight loss with pride.

Level Three interventions. The Level Three interventions for Cerise were medication, CBT, and heart rate variability (HRV) feedback. The physician explained that 6–12 months of antidepressant medicine (Zoloft) could accelerate her improvement (Sadock & Sadock, 2008). CBT explored Cerise's many negative cognitions about her social interactions, work performance, mothering skills, and chances of finding a suitable partner. HRV biofeedback trains the individual to use slow diaphragmatic breathing to create larger regular oscillations in heart rate and increases overall HRV. The rationale for prescribing this form of biofeedback for Cerise, with her sleep disorder, is that HRV is more pronounced during slow-wave sleep than during REM sleep and is elevated during all sleep phases compared to wakefulness (Ebben, Kurbatov, & Pollak, 2009). A series of six sessions of HRV biofeedback helped Cerise to establish a pattern of slow breathing that she utilized each evening at bedtime.

Ten months after Cerise first came to therapy, mood and sleep were significantly improved. Early morning awakenings and daytime fatigue were rare. The exercise program was maintained whether Rachel was with her mom or not. Cerise met a woman who also swam at the YMCA and they formed a friendship, motivating each other to continue. They also talked about adding biking for outdoor exercise in the spring. Negative cognitions significantly decreased and Cerise became more skilled at identifying troublesome maladaptive thinking and countering those thoughts on her own. The physician planned to continue Zoloft for another 3 months and reevaluate at that time, with strong consideration to tapering the medicine.

Case Summary

Sleep disorders can be categorized as primary, when the sleep problem is neither part of an emotional or physical illness nor associated with the use of stimulants. Secondary

sleep disorders are a component of another illness, such as depression, anxiety, or bipolar disorder. In this chapter, Brandon provided an example of a primary sleep disorder, whereas Cerise's sleep problems resulted from her MDD. Both patients' sleep disorders were addressed effectively using the Pathways Model. Brandon was treated with soothing, mindful breathing, sleep hygiene, progressive relaxation, and CBT. Cerise, whose sleep problems were secondary to MDD, began with movement and communication. These Level One interventions were followed by the Level Two interventions of progressive relaxation and physical exercise and the Level Three interventions of CBT, biofeedback, and antidepressant medication.

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